The Roles of AGN and Dynamical Processes in Star Formation Quenching in Nearby Disk Galaxies

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Background

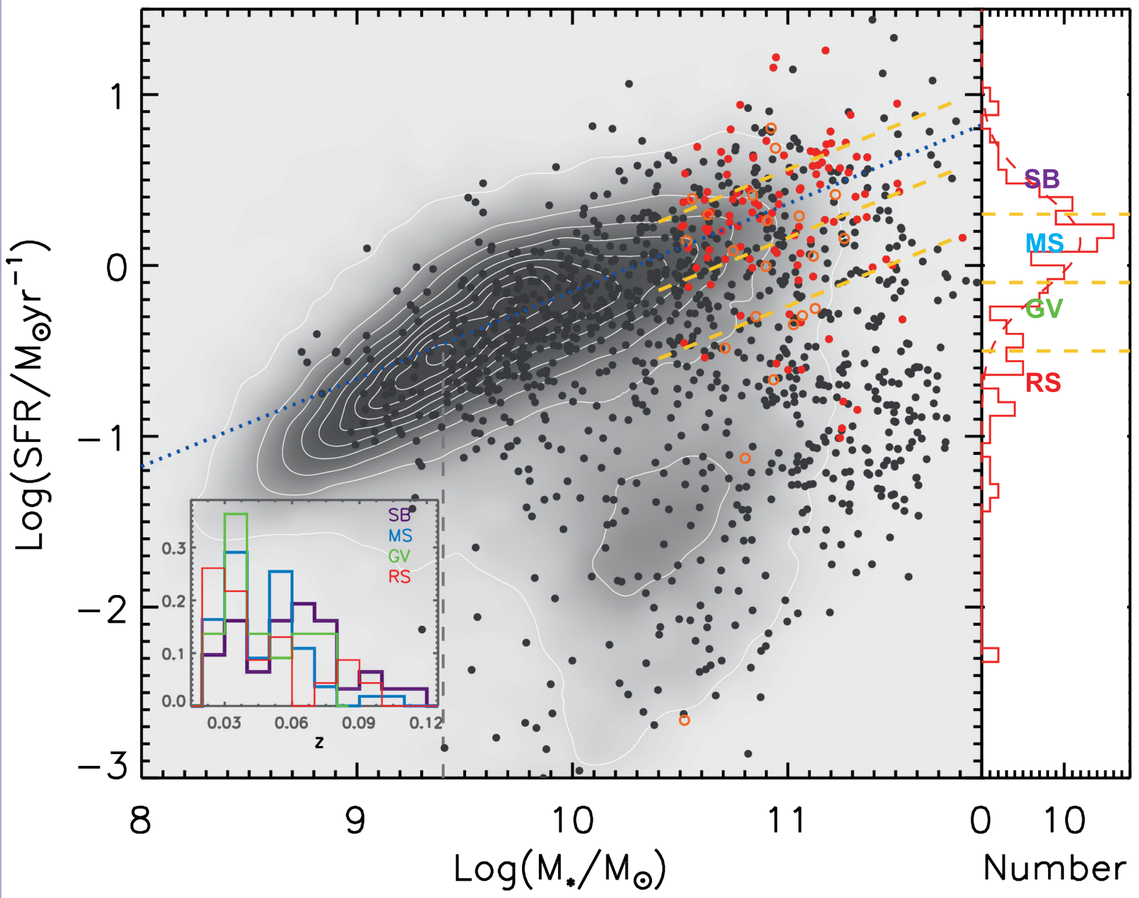
To answer "What lead the star formation quenching in galaxies of local universe?", clues are from "What happens when galaxies start slowing down the rate of star formation".

Given the low merger rate in the local universe[1], AGN feedback[2][3] and secular evolution[4] related with morphology transition[5] are both argued as the candidate of suppressing star formation. Solving the puzzle requires spatially-resolved study of individual galaxies, including the evolution of the galactic stellar structure, and nuclear activity as galaxies fade out of the star formation main sequence.

Data and Sample

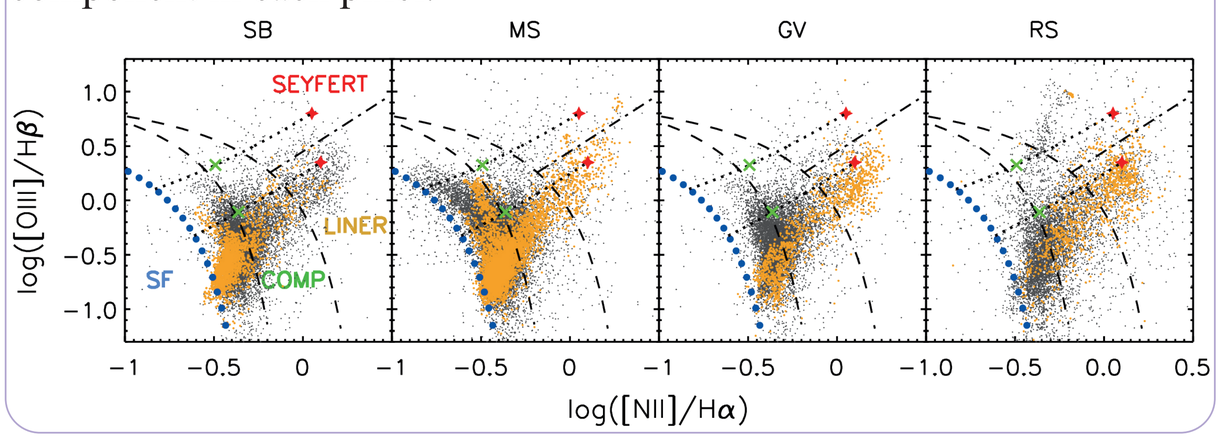
This work is based on MaNGA IFU survey, focusing on the quenching of 131 face-on massive spiral galaxies, the evolution of which is little affected by environmental effects. The package LZIFU is utilized to fit stellar continuum and emission lines.

Galaxies are classified into SB/MS/GV/RS in terms of their integrated star formation rate.



AGN/SF Decomposition

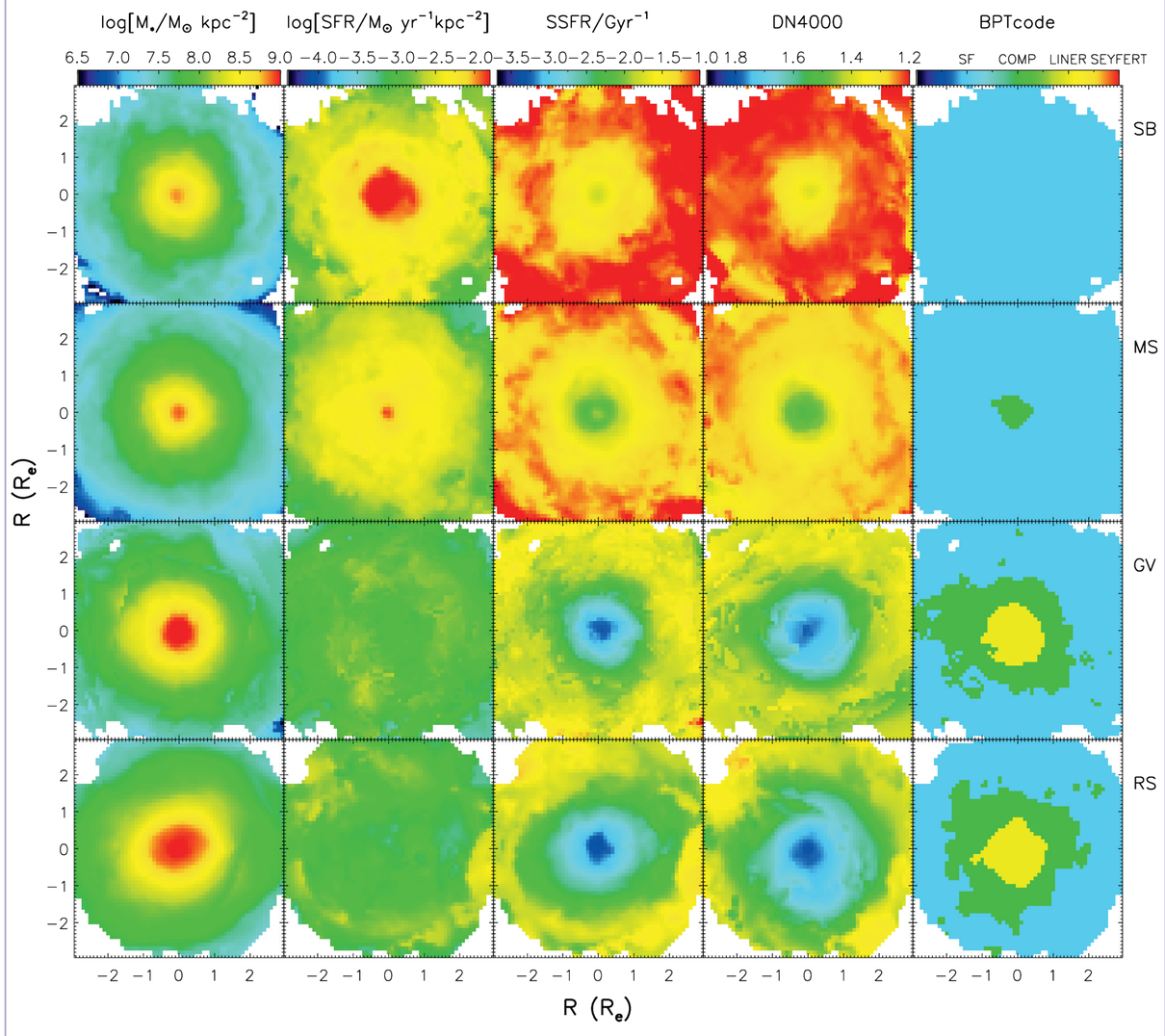
Assuming fixed ratios of emission lines for AGN (or diffuse emission from planetary nebulae) and star formation (blue ridge), we adapt an empirical method[6] to decompose the contribution of either component in each pixel.



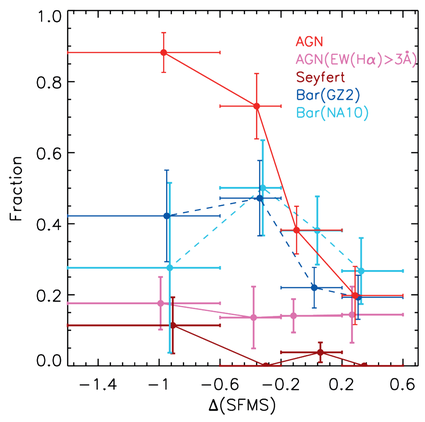
Results

As galaxies slow the speed of global star formation:

- Bulge forms: central stellar mass increase from SB to RS;
- SFR decreases following an inside-out pattern, leaving a "desert" in galaxy center and a "ring-like" structure at 1~2 Re
- Stellar population ages (DN4000 increases) with the SF suppression
- The emission in galaxy center becomes LINER-like since GV



- The fraction of AGN and bar hosts both increase with the fading of global star formation
- Rather than strong AGN like Seyferts, the AGN in GV and RS are mostly low-luminosity AGNs, which affect SF through hot mode feedback.



Conclusion

- The decrease of the global SFR is caused by the suppression of star formation at all radii, but with a more significant drop from the center to outer regions ("**inside-out**");
- **Dynamical processes** and **AGN feedback** are both possible contributors to the inside-out quenching of star formation;
- AGN feedback should operate in **low-luminosity AGN mode**.

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Kexin Guo (pmoguo@gmail.com) is a KIAA postdoctoral researcher. Her research interest focueses on galaxy evolution, including the coevolution between galaxies and AGNs, and the morphology transient during quenching events.

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